U. S. DEPARTMENT OF COMMERCE

TECHNICAL NEWS BULLETIN

OF THE

NATIONAL BUREAU OF STANDARDS

ISSUED MONTHLY

Washington, October 1934. No. 210

CONTENTS

GRADUATION OF PRECISION CIRCLES

The Bureau's circular-dividing engine and the type of graduating work done on it have been briefly described in Technical News Bulletin Nos. 128 and 149 (December 1927 and September 1929). This instrument has been used during the past 9 months in producing graduated circles of a high order of accuracy, for the U. S. Coast and Geodetic Survey.

The triangulation program of the Coast and Geodetic Survey has necessitated the acquiring of a considerable number of graduated circles for new theodolites. Two types of Parkhurst theodolites, for which circles have been supplied, are employed in this program, the first order theodolite using a 9-inch circle, and the second order theodolite using a 6½-inch circle. Both sizes of circles have been made and graduated at the National Bureau of Standards. In addition to the new circles, a number of old ones have been regraduated.

Nearly all of the new circles are of cast sterling silver. A few circles are of duralumin and a few, for regraduation, are of bronze with an inserted sterling-silver ring. These special circles require no particular discussion at this time.

The production of these circles involves the following steps: (1) casting of the sterling-silver disk; (2) heat treatment to relieve the casting strains; (3) machining to approximate size; (4) heat treatment to relieve machining strains and to further stabilize the material; (5) machining to a size suitable for plating; (6) electroplating with silver, using cyanide bath; (7) machining to finished size; (8) inscribing the course series of numbers and graduations; (9) polishing to a plane on pitch-lap with chromium oxide; (10) inscribing the fine numbers; (11) polishing the burrs from the fine numbers; (12) graduating the circle; (13) polishing the burrs from the graduation lines; and (14) filling the lines with special black ink.

With the exception of a few of the first circles, the entire task from the casting of the silver to the completion of the graduated circle was carried out at this Bureau.

In the heat treatment to relieve casting strains, the disks are placed in an electric muffle furnace, and the temperature slowly raised to between 550° and 600° C. with the disks in a reducing atmosphere of illuminating gas. This temperature is held for 2 hours

and the disks are then allowed to cool in the furnace. The second heat treatment, given after the disks are machined nearly to size, is similar to the first one, except that the temperature is only 400° C. and the time 1½ hours. In this second treatment each disk is mounted on a special mandrel so as to be supported as uniformly as possible. The distortion of circles by internal strains is believed to be one cause in the past for what have been regarded as incorrectly graduated circles. These two heat treatments are for the purpose of obtaining as great dimensional stability as possible.

The silver plating was found necessary because it was not possible to graduate the sterling-silver disks and obtain the kind of graduation line required, for example, on rolled silver. The crystals of the sterling silver are large, and differ in physical characteristics even in a single circle so that the graduating tool will not cut uniform lines all around the circle. Many of the lines made on the sterling-silver crystals seem to be torn rather than cut.

The polishing of the circle is an essential part of the present procedure. This is not done to produce a reflecting surface but for the purpose of getting a true plane for two reasons, first because the accuracy required demands it and secondly because lines with smooth, sharp edges can be made only on such a surface.

In the actual graduation of the circles several changes and improvements have been made, perhaps the most important of which is that of using a specially constructed diamond point, adjusted so that a very fine shaving is cut out of the material, leaving sharp edges to the line and a very small amount of burr which is quickly removed with a pitch-lap and chromium oxide. No charcoal is used in the process at any time.

Although several changes in the ruling mechanism of the dividing engine were found necessary, the principal elements of the machine, the main central bearing, the worm, the gear-teeth around the periphery of the central table, and the contour of the correcting-device, were found to be satisfactory.

After the circles have been completed they are checked on the Bureau's circle-testing machine. Because of the limited time a complete test of the circle cannot be made, but with the microscopes set 90° apart it is possible to determine with fair accuracy whether or not the graduations are uniformly spaced.

The Coast and Geodetic Survey then makes a more extended test of the circles when actually mounted in a theodolite. A series of collimators set up around a room with the theodolite in the center enables measurements to be made just as they would be in the field, sighting many miles away. The results obtained in these tests agree with those made by this Bureau within the range of experimental error.

There is considerable difficulty in stating precisely how accurate these circles are. When it is considered that there are 4,320 lines on each of these circles and that on these 9-inch circles an angle of 1 second is about 0.00002 inch, one must have considerable numerical data to support any statement made. These circles certainly are accurate within the tolerance of 2 seconds of arc given in the specifications. It is believed that they may be within approixately ±1 second.

The successful carrying out of this program of preparation, graduation, and calibration of precision circles at the National Bureau of Standards has involved the fullest cooperation of several technical divisions of the Bureau, particularly the divisions of metallurgy, chemistry, optics, and weights and measures. L. V. Judson, chief of the length section, has had the immediate supervision of this program and B. L. Page has carried out the actual graduation of these articles.

A paper giving more detailed technical description of this work is in preparation.

SILVER IN CHEMICAL EQUIPMENT

American silver producers recently established a research associateship at the Bureau to make a survey of the existing and potential uses of silver as an engineering material. The chemical industries have for some time employed silver and silver-lined equipment for certain processes. A brief review of such uses of silver is given in the present paper and mention is made of a few suggested potential uses in similar fields.

Strong alkalies which have a vigorous action upon base metals and refractories can be handled readily in pure silver. Sodium and potassium hydroxides can be melted and cast in silver vessels without appreciable contamination of the product or attack upon the containers and molds.

Silver equipment has been used where dilute hydrochloric acid was one of the products, but cannot be considered as suitable for general use in the manufacture of this material. On the other hand, chlorine, which also attacks silver, can be handled in silver apparatus in both the wet and dry conditions because of the adherent coating of silver chloride which is not soluble under these conditions.

Organic acids and compounds can for the most part be handled successfully in silver equipment. Acetic acid, for example, does not attack silver even at the point where the hot vapors condense during distillation. Glycerine which is intended for pharmaceutical use has sometimes been shipped in steel barrels lined with silver.

The use of silver in the manufacture of gelatin and food products such as jams and fruit juices is not unusual abroad. White vinegar intended for use in pickling can be made without danger of discoloration in silver equipment.

AUTOGRAPHIC THERMAL EXPANSION APPARATUS

An autographic thermal expansion apparatus, designed and constructed at the Bureau, is described in the October number of the Journal of Research (RP722). The methods used in its calibration and comparison with the Bureau's precision expansion apparatus are explained. The autographic expansion apparatus employs the optical lever method of measuring expansion and is suitable for many purposes in commercial laboratories where the highest precision is not required. Expansion curves can be obtained photographically or points on a curve can be observed during the progress of the test. Coefficients of expansion can be determined from these curves, and transformation regions, if present, can also be located. For ordinary materials such as steel, it may be stated that the error of the autographic expansion apparatus is about 6 percent for the range from 20 to 100° C and about 3 percent for the range 20 to 500° C. This apparatus does not give as accurate results as the fused-quartz expansion apparatus which was also designed at the Bureau for use in commercial laboratories.

FINENESS OF MOLDING SAND

A knowledge of the fineness of the size distribution or the constituent particles of a molding sand is decidedly important. No difficulty is encountered in sizing relatively large particles with sieves; however, for particles of smaller diameter than 50 microns, other methods must be employed. Recent work in the experimental foundry of the Bureau has shown that a modification of the sedimentation method can be readily applied in such cases. By means of a transfer pipette a sample is taken of a water suspension of the molding sand which has been allowed to settle for a definite period of time which depends upon the size separation desired. The weight of this sample, after being evaporated to dryness, affords a basis for calculating, on a percentage basis, the size distribution of that portion of the original material which is too fine to be classified by sieve analysis. The method can be simplified somewhat for use as a rapid method suitable for clay substance determinations in foundry-control work and routine testing. For the determination of the fineness of molding sands the pipette method surpasses other available methods in ease of manipulation and scope of information obtained.

RUNNING QUALITY OF ALUMINUM

The determination of the various factors which affect the casting qualities of a metal is of great importance to the foundryman. Methods for evaluating the effects of such factors are usually of a practical nature and designed to be carried out in the foundry under service conditions. A reliable indication of the casting or "running" quality of a metal can be obtained by casting, under carefully controlled conditions, a small spiral strip of a cross section which is small relative to its length. The length of spiral obtained is then a numerical measure of running quality of the metal under the given set of conditions.

The running quality of 2 grades of aluminum, pure and commercial, and of an alloy of 8 percent copper with commercial aluminum has been studied at the Bureau under a number of conditions, by making these spiral castings. The results are set forth in RP727 in the October number of the Journal of Research.

It was found that a linear relation exists from 659 to 801° C. (1,220 to 1,475° F.) between length of spiral and the temperature at which the casting is poured, and that for a given pouring temperature shorter spirals are obtained when the metal had been superheated to 849° C. (1,560° F.) than when it had been superheated to

748° C. (1,380° F). This is probably due to the formation of greater quantities of aluminum oxide at the higher temperature which interfere with the running of the metal.

In addition to a number of minor effects, it was found that aluminum of 99.8 percent purity produced spirals about one and a half times as long as commercial aluminum of 99.2 percent purity.

VACUUM FUSION METHOD FOR DETERMINATION OF GASES IN METALS

The applicability of the vacuum fusion method for the determination of oxygen, nitrogen, and hydrogen in metals, has been established for plain carbon steels but not, as yet, for alloy steels which are so important in modern metallurgy. The difficulty in the field of alloy steels has resulted from the lack of reliable auxiliary methods of analysis to confirm the results obtained by the vacuum fusion method.

It is believed, however, that two methods, neither of which is satisfactory alone, can be combined to yield satisfactory results for certain types of alloy steels. If this belief is confirmed by the experimental work now being initiated at the Bureau, the applicability of the vacuum fusion method to alloy steels can be determined.

PROPERTIES OF GRAY CAST IRON AS AFFECTED BY CASTING CONDITIONS

The Bureau has been investigating the effect of maximum heating temperature on the physical properties of cast iron. The strength of cast iron is known to be a function of the amount and distribution of the graphite present and also of the structure of the ground mass. From a theoretical consideration, the maximum strength is associated with small globular graphite flakes in a pearlitic or sorbitic matrix. The structure is largely controlled by composition, melting practice, and heat treatment of the casting, as has been found by many investigators.

RP726 in the Journal of Research for October, describes the methods and results obtained in a study of three types of cast iron. Four heats, all melted in a high-frequency induction furnace, were made of each type of iron with maximum heating temperatures of the liquid metal at 1,400, 1,500, 1,600, and 1,700° C, respectively. Four parts of transverse test bars, each pair of a different diameter, were cast in a dry sand mold and the following properties studied: transverse breaking load, deflection, moduli of rupture and elasticity, hardness, density, and microstructure.

The density-temperature relation in the liquid state, for each of the three irons was not affected by the degree of superheat.

The strength of a bar of given diameter was found to depend on the maximum heating temperature. In two types of iron this maximum did not occur at the same maximum heating temperature for bars of different diameter. In the third type of iron, the transverse breaking strength increased progressively up to 1,600° C for bars of all diameters.

The running quality of the irons investigated was not materially affected by the maximum heating temperature, but was found to be a function of the liquidus temperature. For any two irons poured at the same temperature, the running quality was found to be better in the case of the iron having the lower liquidus temperature.

The microstructure of the 1.2-inch bars indicated that high strength is associated with relatively small graphite flakes and a pearlitic-sorbitic matrix.

ACCELERATED TESTS OF NICKEL AND CHROMIUM PLATING ON STEEL

In order to specify and check the quality of plated coatings on steel, it is desirable to employ accelerated tests which can be performed in a short time. For the results of such tests to be valid and useful, they should be at least approximately parallel to the behavior of similar coatings in actual service. In cooperation with the American Electroplaters' Society and the American Society for Testing Materials, exposure tests of plated steel were made recently by the Bureau and the results are given in the October number of the Journal of Research (RP724). Similar specimens were used in accelerated tests to determine the relation between the results of the two procedures.

It is not practicable to include in accelerated tests all of the factors that may influence atmospheric corrosion. Efforts to introduce small concentrations of sulphur dioxide yielded results entirely different from those in industrial atmospheres that contained smaller and more variable amounts of sulphur compounds. The most reproducible and most significant results were obtained with a solution of sodium chloride (common salt), at a temperature of 35° C (95° F).

In a salt-spray test a 20-percent solution of sodium chloride is converted to a fine mist or fog which surrounds the specimens. In the intermittent-immersion test, the specimens are subjected to successive 15-minute cycles, each consisting of 1 minute in a similar salt solution and 14 minutes in air.

It was found that the time required in these tests for the first appearance of even slight rust is not a proper criterion of quality. If, however, the number and size of the rust spots at the end of a definite period, such as 100 hours, are recorded, the results are approximately parallel to those of exposure tests, though small differences in the latter are not readily detected in accelerated tests.

As the protective value of coatings of this type depends principally upon their freedom from porosity, a rapid test for porosity is useful. The ferroxyl test, in which blue spots are produced wherever steel is exposed, is applicable to coatings consisting of copper, nickel, or chromium. It is conveniently applied in the form of paper saturated with the solution containing potassium ferricyanide, whereby a permanent record of the pores is made. The results are roughly parallel to those of accelerated and atmospheric tests.

INFLUENCE OF CHEMICALLY AND MECHANICALLY FORMED NOTCHES ON FATIGUE OF METALS

Numerous failures of parts of machinery may be attributed to stress concentration at notches, oil holes, grooves, tool marks, or other abrupt changes of section. Because of this stress concentration, these parts fail under stresses that would not cause failure if the surface were smooth. Corrosion pits have similar damaging effect. This effect is due less to general loss of section than to stress concentration caused by corrosion pits. In RP725, in the October number of the Journal of Research, the damaging effect of corrosion pits or other notches is shown to increase with increase in hardness or strength of the metal. Thus, the corrosion time required to cause serious loss of resistance to repeated stress is much less for high-strength than for low-strength steels. For example, the time required to cause 15 percent damage was about 60 days for a low-strength steel, but less than 1 day for a spring steel.

The damaging effect of a notch, however, differs greatly for metals of different types. The effect of a notch on copper, for example, is greater than the effect on steel of the same strength. This paper considers the relationship of notch sensitivity to various other properties such as work-hardening capacity. It also shows that the presence of a sharp notch may counterbalance any advantage of superior strength. Under such conditions, effort spent in producing a metal with high strength may be largely wasted.

HEAT OF COMBUSTION OF STANDARD SAMPLE BENZOIC ACID

The heats of combustion of solid and some liquid fuels, and of a large number of pure organic chemical compounds are most readily measured by means of the bomb calorimeter. This consists essentially of a bomb in which a sample of the substance whose heat of combustion is desired may be burned in oxygen under pressure, a vessel containing a weighed amount of water, and a thermometer.

To measure the heat of combustion of a given material, a weighed amount of it is placed in the bomb, oxygen is admitted to the desired pressure, the bomb is immersed in the water of the calorimeter, and the temperature of the water is observed. The material is then ignited by means of an electrically heated wire and after the combustion is complete the temperature of the water is again observed.

From the mass of the sample burned, and the rise in temperature resulting from the combustion, the heat produced by the combustion of unit mass of the material can be calculated provided the heat capacity of the calorimeter is known, that is, the quantity of heat required to raise the temperature of the calorimeter by one degree.

The heat capacity of a bomb calorimeter may be determined by supplying a measured quantity of heat electrically, and observing the resultant rise in temperature. While this is the most accurate method, it requires considerable time, and involves the use of expensive equipment which is not available in many laboratories.

A much more convenient method is to burn in the calorimeter a known mass of a substance, the heat of combustion of which has been previously determined, and observe the temperature rise produced. Among the substances which have been used for this purpose are sucrose, napthalene, salicylic acid, and benzoic acid. Of these, benzoic acid has proved most suitable, and the Bureau has for a number of

years furnished standard samples of this substance for use in calibrating bomb calorimeters.

Samples of this substance prepared at different times may differ slightly in purity. This makes it necessary to determine the heat of combustion of each lot of material used for the standard samples. RP721 in the October number of the Journal of Research describes measurements of the heats of combustion of two lots of benzoic acid, which are of a high degree of purity and uniformity.

The measurements were made in a calorimeter, the heat capacity of which was determined by supplying a measured quantity of energy electrically and observing the rise in temperature produced. Temperatures were measured by means of a platinum resistance thermometer capable of detecting a temperature change of less than 0.001° C. Corrections were applied to take account of heat transfer between the calorimeter and its surroundings and the heat produced by stirring of the water of the calorimeter, and of the energy used to ignite the sample. The experimental conditions were varied over a wide range, so as to detect possible systematic errors.

The results obtained for the heats of combustion of the two lots of material were identical within the limits of accuracy of the measurements, and equal to 26,419 international joules per gram, when the sample is burned under specified conditions. The data indicate that this value is probably correct within about 0.02 or 0.03 percent. It is in agreement within 0.03 percent with measurements made in 1928 by Jaeger and von Steinwehr at the Physikalisch-Technische Reichsanstalt, and by Roth, Doerke, and Banse at the Technische Hochschule in Braunschweig, but differs by somewhat larger amounts from values obtained for different lots of material by Fischer and Wrede at the University of Berlin in 1909, and by Dickinson at the National Bureau of Standards in 1914.

STANDARDIZATION OF LOVIBOND RED GLASSES IN COMBINATION WITH 35 YELLOW

Inconsistencies in the grades of Lovibond red glasses have long been a source of annoyance and dispute among oil chemists, who use these glasses in the color grading of vegetable oils. Thousands of such glasses are in use in this country, over 2,300 of them having now been submitted to the Bureau for renumbering. RP718 in the October number of the Journal describes the fundamental standardization of the Bureau's Lovibond red glasses, with which these 2,300 glasses have been compared and in terms of which they have been renumbered. The purpose of the standardization was to derive new numerals for the Bureau glasses, approximately equal in magnitude to the original numerals but free from certain inconsistencies occurring among them. The standardization is based upon spectrophotometric analyses of the glasses when in combination with Lovibond 35 Yellow. The new numerals were derived from colorimetric computations based on the spectral transmission data; they are shown to be on a consistent additive scale which covers a range from yellow to yellowish-red. Tolerances of colorimetric purity and light transmission are considered.

CRITICAL SOLUTION TEMPERATURES OF SOME HYDROCARBONS OF SULPHUR DIOXIDE

To determine the possibility of separating by extraction the hydrocarbons of the naphtha fraction of petroleum the boiling points of which lie close together, the critical solution temperatures of 17 paraffin and naphthene hydrocarbons in some common solvents have been studied at the Bureau. Some of the work of other experimenters was repeated in order to compare the methods, but the chief object of this work was to supplement the data already available. A few critical solution temperatures in aniline were also determined to complete a series for comparison.

The relation between the critical solution temperatures in sulphur dioxide and the boiling points was found to be nearly linear for paraffin and isoparaffin hydrocarbons, while for cyclic compounds the relation is irregular, but not greatly different from that of the normal paraffins. The relation between the critical solution temperatures in aniline and the boiling points is a smooth curve for paraffin and isoparaffin compounds, but the cyclic compounds again exhibit irregularities. The critical solution temperatures in ammonia were determined approximately and found to be related to the boiling points in a manner very similar to those in sulphur dioxide.

It is concluded that the critical solution temperatures in sulphur dioxide and ammonia offer little promise for use of these reagents in the separation of nearly constant boiling mixtures from the naphtha fraction of petro-

leum. The critical solution temperatures in aniline differ more widely than in the other reagents studied. The complete account of this investigation appears as RP728 in the October number of the Journal of Research.

GEL RUBBER HYDROCARBON

Much of the available information about rubber has been obtained by considering rubber as a whole and by studying it without regard to the possibility of its being a mixture of chemical compounds. Because rubber is used industrially in bulk, without separation into possible fractions of different composition, such information is of great technical assistance to manufacturers, as witnessed by the improvement in the quality of rubber goods in recent years. However, another factor should be considered. For instance, in scientific work, or even in technical applications, nobody would attribute to a mixture of salt and soda the properties of salt alone. Similarly, evidence is accumulating that rubber is not a single substance like salt, but is composed of at least two different substances, and is therefore analogous to a mixture of salt and soda. One of these substances, which dissolves in ethyl ether and is therefore called "sol" rubber was described in the Journal of Research for April 1933 (RP544). The second substance, known as "gel" rubber, does not dissolve in ethyl ether in the absence of oxygen. Its preparation and some of its properties are described in RP719 in the October number of the Journal.

The gel fraction of rubber hydrocarbon is insoluble in ether, presumably because of its complex structure and high molecular weight. In the presence of a trace of oxygen, the gel becomes soluble in suitable organic liquids. The dissolved gel has been crystallized from a dilute solution at low temperatures and the crystals have been examined. The refractive indices, ϵ=1.535 at −5° C, and ω=1.583 at −5° C, are very close to the values previously found for crystals of ether-soluble hydrocarbon. The melting temperatures, which lie between approximately −5° C and +14° C, depend upon the history of the sample and indicate that the crystals are solid solutions, probably of many closely related components. Crystals obtained from the ether-soluble fraction melted consistently at 10° C. As witnessed by micromanipulation below their melting temperature, the gel crystals contrast sharply in elasticity with crystals of sol rubber. The former appear to be elastic, the latter are plastic. Also, after the crystals are melted, as indicated by their loss of birefringence, the gel is more resistant to deformation than the sol. Crystals of ether-soluble rubber have been vulcanized below their melting point by means of sulphur chloride. The shape of the crystals remains unchanged, but birefringence, the optical evidence of crystallinity disappears, and their resistance to deformation is increased.

VULCANIZATION AND STRESS-STRAIN BEHAVIOR OF SOL, GEL, AND TOTAL RUBBER HYDROCARBON

In the manufacture of vulcanized rubber products, the raw rubber chiefly used is the species called *Hevea brasiliensis* which grows wild in South America and is extensively cultivated in the Far East. In a method of purification which was developed at the Bureau and which is described in RP720 in the October number of the Journal of Research, *Hevea* rubber is separated into 2 parts by ethyl ether. One part dissolves and the other does not. After separating them, the ether was removed from each portion of the rubber and each was mixed with sulphur and other suitable ingredients, including a slow accelerator of vulcanization, and vulcanized. A sample of the original rubber was vulcanized also. Vulcanized rubbers, prepared from the insoluble portion of the rubber were less extensible, and those prepared from the soluble rubber more extensible, than the vulcanized original rubber. These results were confirmed by using two other methods of vulcanization.

PURIFICATION OF α-*d*-HYLOSE AND ITS MUTAROTATION

The method of purifying sugar solutions by treatment with basic lead acetate has been applied with excellent results to the purification of dark-colored xylose residues from cottonseed hulls. The sirup obtained after such treatment crystallizes during the evaporation and yields a practically colorless product of good keeping quality and high purity.

Mutarotation measurements on the purified product show that the reaction rate decreases during the first few minutes after solution. The work is reported in RP723 in the October number of the Journal of Research.

AMERICAN CONGRESS OF PHYSICAL THERAPY HONORS BUREAU SCIENTIST

The American Congress of Physical Therapy has announced the award of its gold key, "the highest honor within the power of the Congress to bestow", to Dr. W. W. Coblentz, chief of the radiometry section of the National Bureau of Standards, and members of the Council on Physical Therapy of the American Medical Association "for meritorius service to medical science in the field of ultraviolet radiation."

COMMODITY STANDARDS AND NRA CODES

The National Bureau of Standards has completed a survey of commodity standardization as affecting proposed and approved codes of fair competition. Having compiled a complete library of nationally recognized commodity specifications, completely indexed on a commodity basis, and intercompared critically, especially effective service has been rendered to the Consumers' Advisory Board in reviewing all of the proposed Codes of Fair Competition to insure the insertion therein of proper references to quality standards to safeguard the consumers' interest. For 653 of the 1,233 codes and supplements reviewed for the Consumers' Advisory Board, there were located specifications formulated or sponsored by 187 seperate agencies. To these specifications 3,177 individual references were suggested, in addition to a single group of 205 ASTM specifications. In 198 of the 519 codes and groups of codes and supplements that had received official approval up to and including September 30, 1934, there were included definite references to the requirements in existing standards of industries or trades, or to the creation of committees to formulate standards. Of the 85 references in the approved codes and supplements to definite existing standards or designated agencies to cooperate in the preparation of standards, 41 were to the National Bureau of Standards.

In several cases the individual specifications were sponsored jointly by several agencies. The agencies and the number of specifications sponsored thereby are as follows:

GOVERNMENTAL AGENCIES

	References
National Bureau of Standards:	
Simplified Practice Recommendations	219
Commercial Standards	87
Safety Codes	42
Federal Specifications Board	1601
Department of Agriculture	17
Federal Trade Commission	17
American Marine Standards Committee	7
Bureau of Navigation and Steamboat Inspection, Department of Commerce	6
General Supply Committee	5
Interstate Commerce Commission	5
War Department	4
Bureau of Public Roads	2
Congress of the United States	2
Navy Department	2
Bureau of Agricultural Economics	2
Joint Committee on Printing of the U. S. Congress	1
Treasury Department	1
American Society for Testing Materials (205 +)	296
American Standards Association	171
American Society of Mechanical Engineers	71
Society of Automotive Engineers	45
American Gas Association	35
American Association of State Highway Officials	27
American Railway Association	22
Underwriters' Laboratories	20
National Board of Fire Underwriters	17
Association of Official Agricultural Chemists	16
American Bureau of Shipping	15
American Society for Steel Treating	15
American Railway Engineering Association	14
American Society of Heating and Ventilating Engineers	11
International Association of Industrial Accident Boards and Commissions	11
National Safety Council	11
United States Pharmacopoeial Convention	11
American Transit Association	10
Technical Association of the Pulp and Paper Industry	10
National Association of Sheet Metal Contractors	9
National Fire Protection Association	9
Heating and Piping Contractors National Association	8
American Leather Chemists Association	7
Associated General Contractors of America	7
National Association of Building Owners and Managers	7
National Association of Waste Material Dealers	7
National Bureau of Casualty and Surety Underwriters	7
American Concrete Institute	6

GOVERNMENTAL AGENCIES—continued

	References
American Water Works Association	6
Associated Factory Mutual Fire Insurance Companies	6
National Machine Tool Builders Association	6
American Gear Manufacturers Association	5
American Institute of Architects	5
American Institute of Electrical Engineers	5
American Petroleum Institute	5
Electric Hoist Manufacturers Association	5
Manufacturers Standardization Society of the Valve and Fittings Industry	5
National Association of Fire Equipment Manufacturers	5
National Warm Air Heating Association	5
American Mining Congress	4
American Public Health Association	4
American Society of Civil Engineers	4
American Society of Municipal Engineers	4
Association of American Steel Manufacturers	4
National Electrical Manufacturers Association	4
American Chemical Society	3
American Pharmaceutical Association	3
American Railway Association, Mechanical Division	3
American Railway Association, Operating Division	3
American Railway Association, Signal Section	3
American Society of Agricultural Engineers	3
American Society of Refrigerating Engineers	3
Associated Tile Manufacturers	3
Association of Edison Illuminating Companies	3
Association of Iron and Steel Electrical Engineers	3
Illuminating Engineering Society	3
National Association of Insecticide and Disinfectant Manufacturers	3
National Founders' Association	3
Tire and Rim Association	3
Amateur Billiard Association of America	2
Amateur Bowling Congress	2
American Amateur Athletic Union of the United States	2
American Ceramic Society	2
American Drop Forging Institute	2
American Engineering Council	2
American Institute of Homeopathy	2
American Railway Association, Purchases and Stores Division	2
American Road Builders Association	2
American Society of Bakery Engineers	2
American Wood-Preservers' Association	2
Asphalt and Mastic Tile Association	2
Associated Manufacturers of Water Purifying Equipment	2
Association of Governmental Officials in Industry of the United States and Canada	2
Cast Stone Institute	2
Concrete Masonry Association	2
Diamond Core Drill Manufacturers Association	2
Diesel Engine Manufacturers Association	2
Institute of Radiator and Boiler Manufacturers	2
Laundryowners' National Association	2
Machinery Builders Association	2
National Association of Dyers and Cleaners	2
National Association of Glue Manufacturers	2
National Association of Mutual Casualty Companies	2
National Association of Professional Baseball Leagues	2
National Collegiate Athletic Association	2
National Florists Council	2
National Metal Exchange	2
National School Supply Association	2
Paint, Varnish, and Lacquer Manufacturing Industries	2
Plumbago Crucible Association	2
Portland Cement Association	2
Society of Motion Picture Engineers	2
U. S. Field Hockey Association	2
U. S. Lawn Tennis Association	2
Aeronautical Chamber of Commerce	1
American Association of Feed Control Officials	1
American Association of Textile Chemists and Colorists	1
American Concrete Pipe Association	1
American Dental Association	1
American Electric Railway Engineering Association	1
American Electro Platers' Society	1
American Institute of Baking	1
American Institute of Steel Construction	1
American Paint and Varnish Manufacturers Association	1
American Railway Association, Engineering Division	1
American Society of Agricultural Chemists	1
American Society of Safety Engineers	1
American Waxed Paper Association	1
Anthracite Institute	1
Asbestos Bureau	1
Asphalt Shingle and Roofing Institute	1
Associated Cooperage Industries of America	1
Association of Manufacturers of Chilled Car Wheels	1
Association of Official Analysts of North America	1

GOVERNMENTAL AGENCIES—continued

	References
Bell Telephone System	1
California Redwood Association	1
Clay Products Institute of California	1
Compressed Air Society	1
Consolidated Freight Classification Committee	1
Contracting Plasterers International Association	1
Edison Electric Institute	1
Fire Protection Group	1
Forged Tool Society	1
Glass Container Association	1
Glycerine Producers Association	1
Grinding Wheel Manufacturers Association	1
Hydraulic Society	1
Indiana Limestone Institute	1
Institute of Radio Engineers	1
International Association of Ice Cream Manufacturers	1
International Association of Milk Dealers	1
Joint Concrete Culvert Pipe Committee	1
Maple Flooring Manufacturing Association	1
Mirror Manufacturers Association	1
National Association of Amusement Parks	1
National Association of Furniture Manufacturers	1
National Association of Musical Merchandise Manufacturers	1
National Association of Paint Manufacturers	1
National Association of Rock and Slag Wool Industries	1
National Association of Wool Manufacturers	1
National Bakers Council	1
National Better Business Bureau	1
National Building Granite Quarries Association	1
National Concrete Burial Vault Association	1
National District Heating Association	1
National Hair and Jute Association	1
National Hardwood Lumber Association	1
National Luggage and Leather Goods Manufacturing Association	1
National Oak Flooring Manufacturers Association	1
National Screw Thread Commission	1
New England Water Works Association	1
New York Board of Trade	1
Northern Hemlock and Hardwood Manufacturers Association	1
Outdoor Advertising Association	1
Portland Cement Association	1
Pyroxylin Plastics Manufacturers Association	1
Railway Fire Protection Association	1
Refrigerating Machinery Society	1
Rug Chemical Processing Association	1
Scientific Apparatus Makers	1
Silk Association of America	1
Southern Cypress Manufacturers Association	1
Southern Pine Association	1
Steel Joist Institute	1
Tanners' Council	1
West Coast Lumbermen's Association	1
Western Pine Association	1
Wholesale Marble Dealers	1
Wire Cloth Manufacturers Association	1

An analysis of the Codes of Fair Competition and supplements thereto thus far approved shows that in 199 of these codes and supplements definite references are made to existing standards or to the creation of committees to formulate standards. In 85 of these approved documents there are the following number of references to 43 agencies under whose auspices the existing standards have been promulgated or which are to be represented on the committees to carry forward standardization.

GOVERNMENTAL AGENCIES

	References
National Bureau of Standards	41
U. S. Department of Agriculture	6
Federal Specifications Board	4
Interstate Commerce Commission	4
U. S. Public Health Service	3
Federal Trade Commission	1
National Screw Thread Commission	1
U. S. Bureau of Mines	1

NONGOVERNMENTAL AGENCIES

American Society for Testing Materials	5
American Society of Heating and Ventilating Engineers	3
American Standards Association	3
American Gas Association	2
Conference of State and Provincial Health Authorities of North America	2
National Association of Flat Rolled Steel Manufacturers	2

NONGOVERNMENTAL AGENCIES—continued

	References
Underwriters' Laboratories	2
American Association of State Highway Officials	1
American Concrete Institute	1
American Home Economics Association	1
American Medical Association	1
American Petroleum Institute	1
American Railway Association	1
American Society of Mechanical Engineers	1
Associated Factory Mutual Fire Insurance Companies	1
Copper and Brass Mill Products Association	1
Grinding Wheel Manufacturers Association	1
Heating, Piping and Air-Conditioning Contractors National Association	1
Institute of Carpet Manufacturers	1
Locomotive Crane Manufacturers Association	1
Mellon Institute	1
National Association of Cleaners and Dyers	1
National Association of Fan Manufacturers	1
National Association of Leather Glove Manufacturers	1
National Association of Sheet Metal Contractors	1
National Board of Fire Underwriters	1
National Slate Association	1
National Warm Air Conditioning Association	1
Sanitary Institute of America	1
Saw Manufacturers Association of America	1
Society of Automotive Engineers	1
Steel Joist Institute	1
United Roofing Contractors Association	1

Below are listed the codes in which definite references are made to existing standards or to the creation of committees to formulate standards, together with indications of the agencies under whose auspices the existing standards have been promulgated or which are to be represented on the committees to carry forward standardization.

TITLE OF CODE	AGENCIES REFERRED TO
Agricultural insecticide and fungicide	ICC, Dept. Agr.
Air valve	NBS
All-metal insect screen	
Artistic lighting equipment	NBS
Asbestos	
Asphalt shingle and roofing	
Atlantic mackerel fishing	
Athletic goods	
Automatic sprinkler	
Bank and security vault	
Baking	
Barber-shop trade	
Batting and padding	
Bedding	
Bias tape	
Bleached shellac	NBS, FTC
Blue crab	
Brass forgings	
Brooms	
Buff and polishing wheel	NBS
California sardine processing	
Can labeling and can casing	
Candles and beeswax	
Candlewick bedspread	
Candy	
Canned salmon	
Canning	
Canvas stiched belt	
Carpet and rug	ICM, NBS
Cast-iron pressure pipe	
Cast-iron soil pipe	FSB
Cement	ASTM, ASA, FSB
Charcoal and package fuel distributing trade	
Cleaning and dyeing	NBS, AHEA, NACD
Coal dock	
Coat and suit	
Cocoa and chocolate	FDA (Dept. Agr.)
Collapsible tube	
Collective manufacturers for door-to-door distributing	Dept. Agr.
Commercial stationery	
Concrete masonry	ACI, ASTM
Copper and brass mill products	CBMPA
Cordage and twine	NBS, FSB
Corrugated rolled metal culvert pipe	AASHO
Corrugated and solid fiber shipping container	ICC
Cotton garment	NBS
Cut tacks, wire tacks, etc	NBS
Cutlery, etc	
Diesel engine manufacturing	NBS
Dog food	
Drapery and carpet hardware	NBS

TITLE OF CODE	AGENCIES REFERRED TO
Dry goods cotton batting	
Earthenware	
Electric storage and wet primary battery	SAE, ARA
Electroplating, metal polishing and finishing	
Excelsior and excelsior products	
Expanding and specialty paper products	
Fan and blower	ASHVE, NAFM
Feldspar	
Fiber wallboard	
Filing supply	
Fire resistive safe	NBS, UL
Fisheries	
Flag	
Flavoring products	
Flexible insulation	
Floor and wall clay tile	NBS
Forged tool	NBS
Fresh oyster	
Fresh water pearl button	
Funeral supply	
Furniture and floor wax and polish	NBS
Gas cock	AGA
Grinding wheel	GWMA
Hack-saw blade	
Hair and jute felt	
Handkerchief	
Hardwood distillation	USPHS
Hats	
Hatters' fur cutting	USPHS, CSPHANA
Heating, piping, and air-conditioning	HPACCNA
Horseshoe and allied products	
Household ice refrigerator	ASA
Ice cream cones	Dept. agr.
Imported date packing	
Imported green olive	Dept. Agr., NBS
Industrial safety equipment	AGA, Bu. Mines, NBS
Insecticide and disinfectant	Dept. Agr.
Insulation board	
Kalamein	NBS
Knitted outerwear	NBS
Lace	
Laundry	NBS
Leather and woolen knit glove	NALGM
Liquefied gas	NBFU, NFPA, AFMFIC
Loose leaf and blank book	
Lumber and timber products	(Am. Lumber Stds.)
Lye	
Macaroni	
Manganese	NBS
Mayonnaise	
Mechanical packing	NBS
Medium-priced jewelry	NBS
Metal tank	
Mopstick	NBS
Motor fire apparatus	
New England fish and shellfish	
Nonferrous hot-water tank	NBS
Nonferrous and steel convector	ASHVE
Oil burner	UL
Optical retail trade	NBS
Optical wholesale trade	
Oyster shell crushers	
Paper and pulp	
Paper-box machinery	
Pasted shoe stock	
Peanut butter	
Photographic and photo finishing	
Picture moulding and picture frame	
Pipe nipple	NBS
Pipe tools manufacturing	
Plumbago crucible	ASA
Plumbing fixtures	
Porcelain enameling	
Precious jewelry producing	NBS
Preformed plastic products	
Preserve, maraschino cherry, etc	
Printers' rollers	
Processed or refined fish oil	
Public seating	
Pyrotechnics	
Railroad special track equipment	
Raw peanut milling	
Rayon and silk dyeing and printing	
Reclaimed rubber	
Ready-mixed concrete	ASTM
Refractories	ASTM or Mellon Institute
Resilient flooring contracting	
Reinforcing materials	NBS

TITLE OF CODE	AGENCIES REFERRED TO
Restaurant	USPHS, CSPHANA
Retail jewelry	NBS
Retail lumber and building materials	(Am. Lumber Stds.)
Retail rubber tire and battery	
Rock and slag wool	
Roofing and sheet metal contracting	NASMC, NWAH&ACA, NSA, URCANA
Rolling steel door	
Rubber manufacturing	
Rubber tire manufacturing	
Sand-lime brick	
Sanitary napkin and cleansing tissue	
Saw and steel products	SMAUS
School supplies and equipment	
Scientific apparatus	NBS
Screw machine products	NSTC
Secondary steel products warehousing	
Shoe rebuilding	NBS
Shovel, dragline and crane	LCMA
Silk textile	
Silverware	
Slate	NBS
Spray painting and finishing	ASME
Standard steel barrel and drum	ICC, NAFRSM
Steam heating equipment	
Steel joist	NBS, SJI
Steel package	ICC, NAFRSM
Terrazo and mosaic contracting	
Textile processing	
Tile contracting	
Tool and implement	NBS
Trout farming	
Umbrella frame and hardware	
Underwear and allied products	NBS
Unit heater and unit ventilator	ASHVE
Upholstery spring and accessories	
Upward-acting door	
Valve and fittings	
Vegetable ivory buttons	
Vise manufacturing	
Vitrified clay sewer pipe	ASTM
Vitreous enamel ware	
Wallpaper manufacturing	NBS
Warm air furnace pipe and fittings	NBS
Warm air register	
Waste paper	
Watch case	
Wholesale coal	
Wholesale jewelry	
Wholesale lobster	
Wholesale monument granite	
Wholesale paint, varnish, lacquer, and allied and kindred products trade	
Wholesale stationery	
Wholesale wallpaper	NBS
Wiping cloth	
Wire rope and strand	API, FSB
Wood cased lead pencil	NBS
Wooden insulator pin and bracket	NBS
Woolens and trimmings distributing trade	

COMMERCIAL STANDARD FOR DOMESTIC COAL BURNERS

Commercial Standard CS48–34 for domestic burners for Pennsylvania anthracite (underfeed type) has just been released in printed form. This standard is based on the approval code of the Anthracite Institute Laboratory, for domestic underfeed stokers and was presented at the request of that laboratory and adopted by a general conference of manufacturers, coal producers, distributors, and users on March 14, 1934.

The purpose of the industry in establishing this commercial standard was to provide a nationally-recognized basis for certification of quality and performance by the manufacturer, the installing contractor, or by a neutral inspection agency or testing laboratory. Buyers may also use it as a basis for performance criteria and tests. It is believed that its application will protect users from receiving inferior equipment, and the industry as a whole will be protected against destructive effects following the sale of burners that may cause trouble and dissatisfaction, through overrating or other improper claims.

The standard covers minimum requirements for material, design and construction, installation, including the design and capacity of coal storage, conveying and ash removal systems, as well as means for adequate lubrication, draft, fans, controls, capacity, workmanship, and flue connections. Operating requirements are

given, together with methods for determining ratings and efficiency.

A recommended form of certification by both the manufacturer and installing contractor is incorporated in the standard. A brief history of the project and a list of the acceptors at the time of publication is also given.

Particular effort was made to avoid requirements which would interfere with new and improved design and construction.

In order to facilitate the revision of the standard to keep it abreast of progress, a standing committee of manufacturers, distributors and users was appointed; the personnel of this committee is given in the printed pamphlet.

The effective date for new production was August 1, 1934. Copies of this publication can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

THE SYSTEM CaO–B_2O_3–SiO_2

Under this title, an error occurs in line 4, first column, p. 89 of Technical News Bulletin No. 209, September 1934. This line should read: "C_2S, $CB.C_3S$, $C_2B.CS$, $C_2B.C_2S$, $C_2B.C_3S$. and ____"

NEW AND REVISED PUBLICATIONS ISSUED DURING SEPTEMBER 1934

Journal of Research[1]

Bureau of Standards Journal of Research, title page and contents to vol. 12, January to June 1934 (RP630 to 690, inclusive). Free on application to the National Bureau of Standards.

Journal of Research of the National Bureau of Standards, vol. 13, no. 3, September 1934 (RP nos. 709 to 717, inclusive). Price 25 cents. Obtainable by subscription.

Research Papers[1]

[Reprints from the June and July 1934 Journal of Research]

RP688. Preece test (copper-sulphate dip) for zinc coatings; E. C. Groesbeck and H. H. Walkup. Price 5 cents.

RP692. Heats of combustion and of formation of the normal paraffin hydrocarbons in the gaseous state, and the energies of their atomic linkages; F. Rossini. Price 5 cents.

RP694. Equilibrium volatility of motor fuels from the standpoint of their use in internal-combustion engines; O. C. Bridgeman. Price 10 cents.

Circulars[1]

Revised Supplement to NBS Circular C154 (Sept. 17, 1934). Abridged volume correction table for petroleum oils. Price 5 cents.

Simplified Practice Recommendations[1]

R63–33 (2d ed.). Metal and fiber flashlight cases. Price 5 cents.

R150–34. Copper wire nails. Price 5 cents.

R153–34. Hole sizes for taper tubes for filling cop winders.

Technical News Bulletin[1]

Technical News Bulletin No. 209, September 1934. Price 5 cents. Obtainable by subscription.

OUTSIDE PUBLICATIONS[2]

Miller, D. R., *A reply—can American industry adopt the ISA system of fits?* Industrial Standardization and Commercial Standards Monthly (American Standards Association, 29 West 39th St., New York, N. Y.), **5**, no. 9, 208 (September 1934).

Scott, R. B., Brickwedde, F. G., Urey, H. C., and Wahl, M. H., *Vapor pressures and derived thermal properties of hydrogen and deuterium*, Journal of Chemical Physics (American Institute of Physics, 11 East 38th St., New York, N. Y.), **2**, 454 (August 1934).

Marvin, C. F., Jr., Caldwell, F. R., and Steele, Sydney, *Infrared radiation from explosions in a spark-ignition engine*, National Advisory Committee for Aeronautics (Washington, D. C.), Report no. 486 (September 1934). (Price 10 cents.)[3]

Phelps, F. P., and Bates, Frederick, *Preparation of crystalline β-d-allose*, Journal, American Chemical Society (Mills Building, Washington, D. C.), **56**, 1250 (May 1934).

---

[1] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $2.50 per year (United States and its possessions, Canada, Cuba, Mexico, Newfoundland, and Republic of Panama); other countries, 70 cents and $3.25, respectively.

[2] These publications are not obtainable from the Government unless otherwise noted. Requests should be sent direct to publishers.

[3] Obtainable from Superintendent of Documents, Washington, D. C.

Gibson, K. S., *Visual spectrophotometry*, Journal, Optical Society of America (Cornell University, Ithaca, N. Y.), **24**, 234 (September 1934).

Coblentz, W. W., *Betrachtungen zue ultravioletlichtmessung in absoluten einheiten, Strahlentherapie* (Urban und Schwarzenberg, Berlin, Germany), **50**, 179 (May 1934).

Coblentz, W. W., *Vergleichende untersuchungen über die erythemurrksamkeit und die radiometrisch sich ergebende U. V. intensität bei verschiedenen lichtsquellen als grundlage für die festsezung einer messeinheit.* Strahlentherapie (Urban und Schwarzenberg, Berlin, Germany), **50**, 179 (May 1934).

Dryden, H. L., *Computation of the two-dimensional flow in a laminar boundary layer*, National Advisory Committee for Aeronautics (Washington, D. C.) Report no. 497 (September 1934). (Price 5 cents.)[4]

Rawdon, H. S., *Ferrous metallurgical developments during past five years*, Metals and Alloys (Chemical Catalog Co., 3619 Forbes St., Pittsburgh, Pa.), **5**, 207 (September 1934).

Mutchler, W. H., *The weathering of aluminum sheet materials used in aircraft*, National Advisory Committee for Aeronautics (Washington, D. C.) Report no. 490 (September 1934). (Price 15 cents.)[5]

Thompson, J. G., *A review of the monograph on arsenical and argentiferous copper by J. L. Gregg*, Industrial and Engineering Chemistry (Mills Building, Washington, D. C.), news edition, **12**, 321 (September 1934).

[4] [5] Obtainable from Superintendent of Documents, Washington, D. C.

U. S. GOVERNMENT PRINTING OFFICE: 1934